

COMPARISONS OF ASPECTS OF BREEDING BLUE-WINGED AND CINNAMON TEAL IN EASTERN WASHINGTON

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Blue-winged (*Anas discors*) and Cinnamon (*A. cyanoptera*) teal are closely related members of the blue-winged duck group (Johnsgard 1965, McKinney 1970). Habitat selection, social behaviors, and plumages of females and juveniles of these teal species are quite similar (Johnsgard 1965, McKinney 1970, Bellrose 1976, Palmer 1976). The species' ranges overlap in many parts of the Northwest, although the Blue-winged Teal is a relatively recent pioneer in eastern Washington (Wheeler 1965, Connelly 1978). Strong similarities in ecological requirements and behavior indicate that niches of the two species must overlap, but coexistence over major portions of their breeding and wintering range suggests that differences probably exist. The purpose of this study was to examine the hypotheses that breeding time budgets, habitat selection, and social behavior were the same in the two species.

STUDY AREA AND METHODS

The study was conducted on the Columbia National Wildlife Refuge, approximately 13 km northwest of Othello in Grant and Adams counties of central Washington. The refuge encompasses 11,600 ha, mainly within a portion of the Channeled Scablands known as the Drumheller Tract (Johnsgard 1955, Bretz 1959). Since the early 1950s, wetlands in the area have increased in number, size, and permanence as a direct result of the Columbia Basin Irrigation Project. The ratio between Cinnamon and Blue-winged teal numbers on the study area has varied markedly over the past three decades, and was approximately 3:1 at the time of this study. In combination, the two species comprised about 60% of the breeding waterfowl population in the area (Ball et al. 1977, Connelly 1978).

From mid-April through mid-June of 1975 and 1976, pairs and lone males that were thought to be paired were observed; males were considered paired if they showed aggressive behavior typical of territorial defense (Stewart and Titman 1980). Observations were conducted on four study ponds, each less than 1 ha in area and containing less than 50% emergent vegetation. Each of the ponds was used by one to at least three pairs of each teal species. Habitat in the ponds was grossly classified as mudflat, open water, or emergent vegetation. Floating, unrooted, live plants, and floating debris were included in the emergent vegetation category. The activity and habitat occupied by each member of a pair were recorded at 1-min intervals that were established using a modified metronome timing device (Wiens et al. 1970). All social interactions were recorded whenever they were observed. On the few occasions when birds were screened from view, activities were recorded as unknown. Observation effort was apportioned into three time periods (05:00-10:00, 10:01-15:00, and 15:01-20:00 h) at a ratio of approximately 40:30:30. Whenever possible we changed the species being observed each hour to allow equal sampling of both species throughout the

TABLE 1
TIME BUDGET ANALYSIS OF BLUE-WINGED AND CINNAMON TEAL ACTIVITIES IN THE BREEDING SEASON

	N ^a	Percent of time spent					Social interactions
		Feeding	Resting	Locomotion	Comfort movement	Alert	
Blue-winged Teal							
Females	982	66.9	14.4	10.1	5.4	2.5	0.7
Males	1012	61.9	5.7	15.3	5.4	5.8	5.8
Combined	1994	64.3	10.0	12.7	5.4	4.2	3.3
Cinnamon Teal							
Females	1370	63.1	12.8	11.8	6.1	5.0	1.3
Males	1413	50.5	12.5	14.2	6.8	11.8	4.2
Combined	2783	56.7	12.6	13.0	6.5	8.4	2.7

^a N/60 = bird h of observation.

breeding season. Differences in time budgets and habitat use were examined using Chi-square tests.

Many methods have been proposed for describing niche overlap (Horn 1966, Hurlbert 1978), but we chose Schoener's (1968) method because of arguments presented by Abrams (1980) and Linton et al. (1981). Overlap was estimated using the formula $N_o = 1 - \frac{1}{2} \sum_{i=1}^n |p_i - q_i|$, where N_o represents niche overlap, p_i is the frequency of habitat or feeding method used by Blue-winged Teal, and q_i is the frequency of habitat or feeding method used by Cinnamon Teal.

RESULTS

Time budgets were generally similar between the two species (Table 1). Although males and females of both species spent the majority of their time feeding, males spent significantly less time feeding than females (Blue-winged Teal: $\chi^2 = 5.47$, $df = 1$, $P < 0.025$; Cinnamon Teal: $\chi^2 = 46.47$, $df = 1$, $P < 0.001$). Proportion of time spent feeding was significantly lower in male Cinnamon Teal than in male Blue-winged Teal ($\chi^2 = 30.59$, $df = 1$, $P < 0.001$), but females did not differ significantly ($\chi^2 = 1.31$, $df = 1$, $P > 0.05$) in this respect. Females of both species also consistently spent relatively more time than males in resting, and less time in locomotion, alert postures, and social interactions.

Habitat use and feeding methods were virtually identical between the sexes (Connelly 1977), and female ducks are thought to play a dominant role in selection of feeding sites (G. A. Swanson, pers. comm.); consequently, we chose to present only data from females in our analyses of feeding habitat use and methods.

TABLE 2
 PERCENTAGE USE OF HABITAT TYPES BY FEEDING BLUE-WINGED (BWT) AND CINNAMON
 TEAL (CT) FEMALES IN FOUR STUDY PONDS

Habitat	Pond							
	1		2		3		4	
	BWT	CT	BWT	CT	BWT	CT	BWT	CT
Open water	62	49	96	54	30	17	7	3
Emergents	22	33	4	41	62	80	93	94
Mudflats	16	18	0	5	8	3	0	3
N ^a	552	747	377	389	135	186	209	412
Overlap ^b	0.87		0.58		0.83		0.96	

^a Number of feeding observations; N/60 = bird h observed feeding.

^b Schoener (1968).

Feeding Cinnamon Teal used emergent vegetation more than expected (based on proportional availability of habitats) on all study ponds (χ^2 values = 30.67–352.56, $df = 2$, P 's < 0.001). Blue-winged Teal did likewise on three of the four ponds (χ^2 values = 9.80–155.03, $df = 2$, P 's < 0.01). We did not statistically compare feeding habitat use between the two species, but within each wetland Blue-winged Teal were more likely than Cinnamon Teal to feed in open water habitats (Table 2). The reverse situation held in emergent vegetation, but no consistent difference was detected on mudflats. Overlap values for feeding habitat varied from 0.58–0.96 ($\bar{x} = 0.81$, $SD = \pm 0.16$), where a value of 1.0 indicates complete overlap (Schoener 1968).

Dabbling was the feeding method most commonly used by both species overall, but methods differed greatly among habitat types and study ponds. In fact, we found no difference in feeding methods between Blue-winged and Cinnamon teal that was consistent across the four study ponds, even when habitat types were considered separately (Table 3). Overlap values for feeding methods ranged from 0.30–0.98 ($\bar{x} = 0.68$, $SD = \pm 0.29$) in open water and from 0.40–0.97 ($\bar{x} = 0.72$, $SD = \pm 0.25$) in emergent vegetation.

We observed 121 interspecific social interactions; 86 (71%) of these interactions were initiated by Blue-winged Teal and only 35 (29%) by Cinnamon Teal, in spite of the fact that Cinnamon Teal outnumbered Blue-winged Teal by about three to one. Where the outcome of the interaction could be determined, the bird initiating the encounter was the victor in over 90% of all cases (Connelly 1977). Thus, Blue-winged Teal appear to be more aggressive in interspecific social interactions than are Cinnamon Teal. Further support for this contention is offered by the fact

TABLE 3
 FREQUENCY (%) OF FEEDING METHODS USED BY FEMALE BLUE-WINGED (BWT) AND
 CINNAMON TEAL (CT) IN DIFFERENT PONDS AND HABITATS

Habitat	Feeding method	Pond									
		1		2		3		4		Combined	
		BWT	CT	BWT	CT	BWT	CT	BWT	CT	BWT	CT
Open water	Dabbling ^a	49	20	35	36	5	10	100	30	41	25
	Tipping up ^b	6	14	0	0	3	0	0	52	3	10
	Hawking ^c	9	1	65	63	5	19	0	0	36	23
	Head under ^d	36	65	0	1	87	71	0	8	21	42
	N ^e	344	367	362	211	39	31	15	13	760	622
	Overlap ^f	0.63		0.98		0.81		0.30			
Emergent	Dabbling	83	55	80	66	59	74	96	95	84	76
	Tipping up	0	4	0	3	0	0	2	0	1	2
	Hawking	4	2	20	1	0	0	0	0	1	1
	Head under	13	39	0	30	41	26	2	5	14	21
	N	111	238	10	159	85	147	194	388	400	932
	Overlap	0.40		0.67		0.85		0.97			
Mudflats	Dabbling	100	99	0	100	100	100	0	100	100	99
	Hawking	0	1	0	0	0	0	0	0	0	1
	N	88	131	0	17	11	5	0	11	99	164

^a Dabbling—prolonged immersion of some or all of bill; eye is not immersed.

^b Tipping up—head and neck are immersed and tail is elevated above the water surface.

^c Hawking—disjunct pecking movements at individual food items on the water surface.

^d Head under—head is immersed past the eye but tail remains at the water surface.

^e N/60 = bird h of observed feeding.

^f Schoener (1968).

that Blue-winged Teal used active hostile displays in 56% of all interspecific interactions vs 22% of active displays by Cinnamon Teal (Table 4). Similarly, in intraspecific hostile interactions, Blue-winged Teal used active displays in 50% of their encounters and Cinnamon Teal used active displays in only 28% of their encounters.

DISCUSSION

Time budgets and aggressiveness of breeding ducks may vary substantially through the stages of the breeding cycle, and spurious distinctions might be inferred if two species were observed at different stages. However, the breeding chronology of Blue-winged and Cinnamon teal appears similar (Yocom and Hansen 1960, Dwyer 1976, Connelly 1977), and we believe that comparisons between the two species are justified. The general pattern of relatively high foraging rates and few occurrences of alert postures and social interactions in female Blue-winged and Cinnamon teal

TABLE 4

COMPARISON OF DISPLAYS USED BY BLUE-WINGED (BWT) AND CINNAMON TEAL (CT) IN SOCIAL INTERACTIONS

	Interspecific		Intraspecific	
	BWT %	CT %	BTW %	CT %
Passive displays ^a				
Hostile pumping	34	67	47	66
Threat	7	11	3	2
Inciting	3	0	0	4
Subtotal (N)	44 (18)	78 (14)	50 (19)	72 (40)
Active displays ^b				
Chase	46	22	39	26
Rush	10	0	8	0
3-bird flight	0	0	3	2
Subtotal (N)	56 (23)	22 (4)	50 (19)	28 (16)
Total (N)	100 (41)	100 (18)	100 (38)	100 (56)

^a Passive displays involve little or no movement toward another bird.^b Active displays involve pursuit of another bird.

was similar to the situation seen in Blue-winged Teal, Northern Shovelers (*Anas clypeata*), and Gadwalls (*A. strepera*) (Dwyer 1975, Afton 1979, Stewart and Titman 1980). Female teal in our study spent 63.1–66.9% of their off-nest time in feeding, bracketing the 65.5% figure presented for prenesting-incubating Blue-winged Teal females in Manitoba (Stewart and Titman 1980). Male Blue-winged Teal in our study spent nearly twice as much time feeding as did the Manitoba males, suggesting that we may have observed some postbreeding males. Relatively low foraging rates by male Cinnamon Teal in comparison to male Blue-winged Teal may imply differences in foraging efficiency, but also may be related to the fact that male Cinnamon Teal spent nearly twice as much time as male Blue-winged Teal in alert postures. Most alert postures appeared related to actual or potential social encounters.

Johnsgard (1955) studied breeding waterfowl near our study area and suggested that Cinnamon Teal tended to use wetlands with more emergent vegetation than those used by Blue-winged Teal, although he cautioned that his sample size was small. Clearly, habitat use overlaps a great deal between the two species and also varies among wetland types, presumably in response to differing distribution of resources. Still, our data support the idea that Cinnamon Teal are more likely than Blue-winged Teal to feed in emergent vegetation.

Ecological significance of the niche overlap value for feeding methods

is difficult to assess. Our approach, lacking individually identifiable birds, prevented the estimation of intraspecific variation in feeding methods. That variation could provide a baseline for comparison to interspecific variation.

The relatively recent pioneering of Blue-winged Teal into historic Cinnamon Teal range (Wheeler 1965, Connelly 1978) has created a situation where intensive competition would be expected. Habitat use and feeding methods can be almost identical between the species, at least on some wetlands. Territorial defense in the blue-winged ducks may be advantageous in providing the female with undisturbed access to food resources that are critical to the breeding effort (McKinney 1973, 1975; Seymour 1974; Afton 1979; Stewart and Titman 1980). We believe that male Blue-winged Teal, because of their aggressiveness in social interactions, probably have a competitive advantage over Cinnamon Teal in maintaining access to preferred areas, thus helping Blue-winged Teal to become established in an area populated by Cinnamon Teal. Hybridization (Connelly 1977, Bolen 1979, Lokemoen and Sharp 1981) and efficiency of resource use will also affect the eventual outcome of the interaction between the two species; these aspects of the relationship remain virtually unknown.

Statistical comparisons of time budget and habitat use data presented in this paper must be interpreted cautiously. Because we did not mark birds, the total number of individuals studied is unknown; hence the presence of one or more atypical birds in our sample could cause serious, undetected bias in the results. Consequently, we have taken what we feel is a conservative approach in analysis. Furthermore, we urge that the results be tested in other areas, hopefully with marked pairs.

SUMMARY

Time budgets, habitat use, feeding methods, and social behavior of breeding Blue-winged (*Anas discors*) and Cinnamon (*A. cyanoptera*) teal were studied during the breeding seasons of 1975 and 1976 in eastern Washington. Time budgets were similar between the two species. Females fed and rested relatively more than males and spent less time in locomotion, alert postures, and social interactions. Blue-winged Teal were slightly, but consistently, more likely than Cinnamon Teal to feed in open water. Feeding methods overlapped substantially between the two species and varied greatly among habitat types and study ponds. Male Blue-winged Teal were more aggressive than male Cinnamon Teal in both intra- and interspecific social interactions.

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JOINT MEETING OF COOPER ORNITHOLOGICAL SOCIETY AND WILSON ORNITHOLOGICAL SOCIETY

The fourth joint meeting of these societies will be held 5-9 June 1985, at the University of Colorado, Boulder. A 3-day scientific program is scheduled involving contributed papers and several half-day mini-symposia. Early morning field trips are planned to ponderosa pine forests in the foothills, water bird habitats and heronries on the prairie, and open meadows, coniferous and aspen forests in the mountains. All day field trips on 9 June will tour Rocky Mountain National Park or Pawnee National Grassland. Spouse-guest tours will go to historical and art museums in Denver, the Air Force Academy and Broadmoor Hotel in Colorado Springs, the Coors Brewery, and Central City, an historical gold-rush town. The banquet will be held at the Denver Museum of Natural History. The Wilson Society is sponsoring the Sutton competition for excellence in painting of birds by amateurs. The meeting announcement will be mailed in January and abstracts are due by 6 March 1985. Questions can be directed to Dr. Cynthia Carey (local committee on arrangements) or Dr. Carl Bock (scientific program) at: Department of EPO Biology, University of Colorado, Boulder, CO 80309.